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Filter Gallery

The Water We Drink

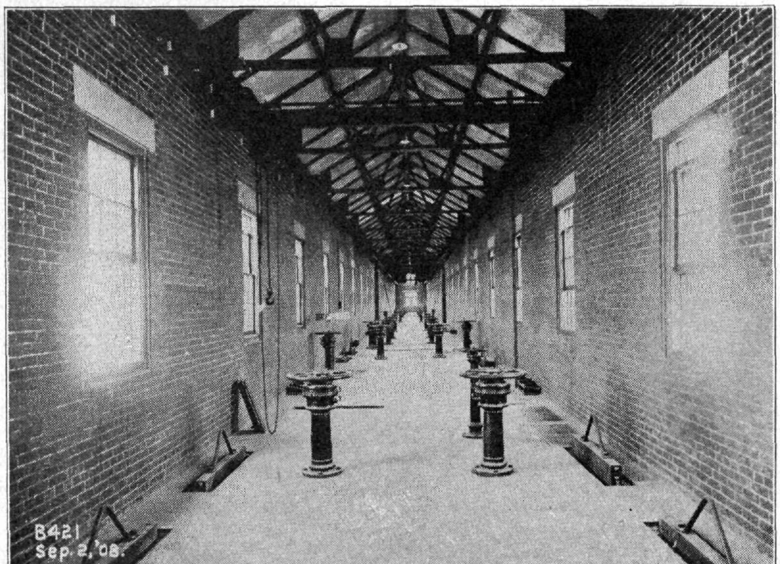
By Hugh B. Lee Jr.

FEW Columbus people realize the size and efficiency of the water-works that provides daily an average of 30,000,000 gallons of pure water to Columbus and vicinity. As a result of enlargement and extension of the plant in 1923, the Columbus water-works became the largest complete water-softening works in the world. Its efficiency is evidenced by the fact that only once since it was put in operation has the plant shut down completely. This was necessary during the 1913 flood, when one of the force mains, laid in the river bed, was washed out, making it impossible to maintain pressure in the distributing system.

This purification plant has been in operation only about twenty-five years. Prior to 1909, the water used in Columbus was not fit for drinking purposes. It was badly polluted with sewage and following heavy rains, was extremely muddy. Because of sewage pollution the water was very unhealthful and typhoid fever and other diseases were prevalent. In 1904 there were one hundred and thirty-five deaths per 100,000 inhabitants from typhoid fever. After the construction of a water purification plant, deaths due to this disease fell off sharply and at present typhoid fever is almost unknown in this city.

The original supply of water was unsatisfactory for domestic or industrial use, because it was highly mineralized. The chemicals and minerals in raw water form deposits in boiler tubes and hot water heating systems, which result in large heat losses. The hardness of the water makes lathering with soap much more difficult than if soft water were used. It is estimated that the softening of water in Columbus effects an annual saving in soap alone of $250,000.

In planning the construction of the purification plant, the engineers were confronted with a difficult situation. A system was needed that must combine efficiency with elasticity and flexibility. The Scioto River from which Columbus takes its water supply is very changeable. It is sometimes clear, sometimes muddy, sometimes soft, and sometimes hard. Specially designed and readily adjustable devices, capable of feeding small and large quantities of chemicals, were needed to take care of the ever changing character of the raw water. The plant as it now stands was constructed with an eye toward overcoming any eventuality that might arise. The design is such that the operating process can be modified without making elaborate changes. Numerous places for applying the chemicals are provided. The water can be separated and treated in portions and the time of mixing can be varied. Raw water can be applied at several different points to correct for over treatment by chemicals.



Gate House

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As a result of this flexibility, after more than twenty-five years of continuous use, the plant is operated as effectively as the most recently built plants.

The outlay of this purification process is necessarily quite involved. The water flows from the river, through two ¼ inch mesh screens which collect most of the leaves and debris contained in the raw water. From the screen house, containing the screens, the water flows through a suction well and is raised by a low lift pump to a height of about 10 feet above the river level. The water then passes through a venturi meter, which measures the flow in millions of gallons, and is then pumped into the receiving compartment of the purification works. Here it is divided into approximately two equal parts. One part without treatment flows directly to the baffled mixing tanks, and the other part, to which is added the entire quantity of lime, soda ash, and alum solutions necessary to soften and clarify the entire supply, flows to mechanical mixing tanks.

The portions of the water receiving the chemical charge is mixed about ten minutes in a series of square tanks provided with rotating paddles. This intermixing of the chemicals added to the water with the mineral salts already present in the water results in the formation of heavy gelatinous precipitates known as flocs. Under these conditions a number of reactions take place. The magnesium compounds are precipitated and the lime present combines with the magnesium to form magnesium hydroxide, a bulky gelatinous precipitate, which coagulates readily. It is, however, impossible to precipitate magnesium, unless an excess quantity of lime is applied. This, then, is the reason why separate treatment is used.

This over-treated portion of the water, with floc already formed, joins the other portions of untreated raw water at the entrances of the baffled mixing tanks, and the two are mixed together thoroughly for about an hour. The baffled mixing tanks are equipped with a series of metal strips projecting alternately from the top and bottom so as to produce a swirling effect where water is directed through the tanks. Floc formation having already been started, further floc-forming reactions take place readily in the baffled mixing tanks. The size of the floc grows as the water rolls successively over and under the baffles.

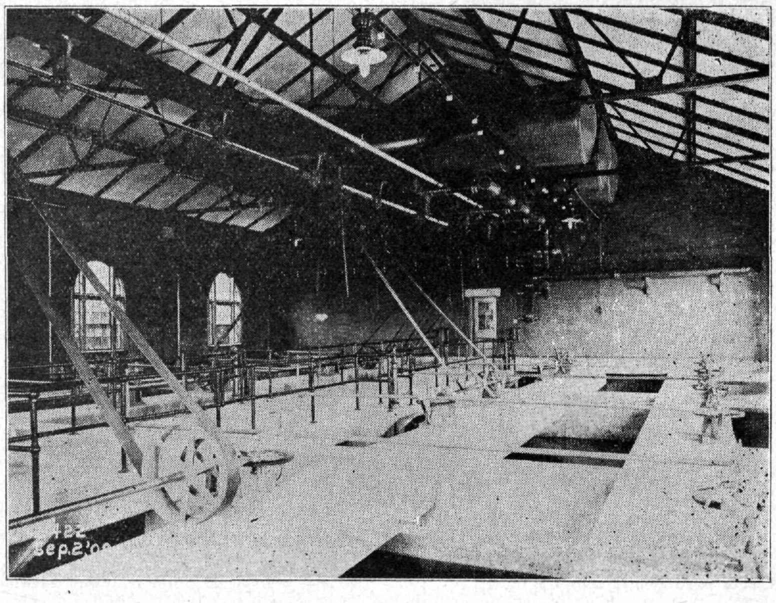
From the baffled mixing tanks the water flows to the settling basins. These basins consist of three divisions each. The mud and precipitated chemicals settle to the bottom of these basins, practically all of it being removed in the first two. In order to keep the efficiency of the settling basins at a maximum it is necessary to wash them at regular intervals. Under normal conditions the first two basins are washed every three weeks, the second two, four times a year; and the last two, twice a year. Flood conditions necessitate washing more frequently.

Just before the clear softened water leaves the settling basins carbon dioxide gas is applied in order to neutralize any excess of lime. It also converts the normal carbonates to bi-carbonates. This reaction stabilizes the water and prevents deposits in the filters or distributing system.

After carbonization, the water discharges from the settling basins into the filters. Here it is filtered through a twenty-four inch layer of sand and an eighteen inch layer of gravel, through strainers and into the filtered water reservoir below. As it discharges from the filter into the reservoir a small quantity of chlorine gas is added to safeguard the purity of the water.

The filters which are eighteen in number are washed out on an average of every seventy-two hours; however, during floods when the mud content is high, the filters are washed as often as once every fifteen hours. The process of washing the filters takes approximately six minutes to complete and consists of the following steps:

1 Close raw water valve
2 Filter down as much water as can be saved
3 Open sewer valve



Agitation House

4 Open wash water valve

5 Wash for six minutes or until approximately 55,000 gallons of wash water has been used

6 Refill filter throughout.

From the filtered reservoir the water is pumped by means of high-lift pumps into the distributing system to the consumers.

Improvements are continually being made to increase the efficiency of the plant. One new feature added a few years ago was a new method for handling lime. Originally, the lime was handled and stored in canvas bags. In order to increase the storage capacity, and to lessen the labor and cost of hauling the lime, a concrete storage bin was built. Lime is elevated into it by a conveyor. A cross conveyor carries it to daily supply hoppers. From the daily supply hoppers the lime drops into automatic weighing scales, which weigh it into solution tanks from which it is fed into the water.

Carbon dioxide gas is now manufactured at the plant by the process of recarbonation. The gas making and distributing plant consists of six principal parts, a gas producer, a gas burner, a return boiler, a steam-driven air compressor, a combination scrubber and drier, and a diffuser. In operating, coke is burned in the gas producer, which is a closed furnace with a control air supply furnished by a boiler. The products of combustion pass from the gas producer to the gas burner, where they are mixed with air and burned to complete combustion under the boiler. The steam produced is used to drive the air compressor and blower. The plant is located in the boiler room of the pumping station and the steam produced is connected to the main steam line. The air compressor takes its suction from the producer gas burning boiler through a scrubber and drier, and forces the washed gases through diffusers into the water to be carbonated. Making producing gas from coke and burning it under a boiler, is perhaps the most economical method of producing carbon dioxide gas.

These and numerous other improvements, which have been added in recent years, have helped to maintain the high standing of the Columbus Water Softening and Purification Works as an exponent of efficient and thorough treatment of water.

With Spinach for Dessert

"Do you enjoy your meals?" asked the doctor.
"No," he growled.
"What do you have, usually?" went on the medico.
"Scraps at all of them," he said.

Success Story

The undertaker's very smart,
He'll never need the dole.
For he gets rich when other folks
Are going in the hole.

—*Selected.*